Joint US/German In Situ Bioremediation Demonstration

An Extension of a Successful Technology for Broader Application

The Problem

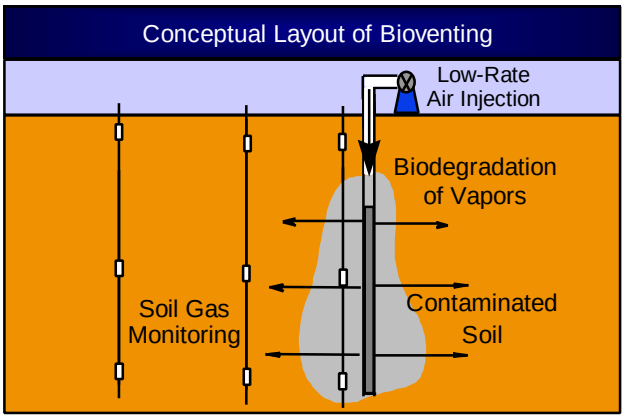
Petroleum releases to the environment have occurred at many fuel-handling facilities, including those located overseas. These releases cause residual contamination in the unsaturated and capillary fringe zones that often serve as long-term sources of groundwater contamination. These contaminants will biodegrade naturally, if native soil bacteria have an adequate supply of O_2. However, natural soil diffusion rates of O_2 are usually too low to accomplish biodegradation before the contamination spreads to the groundwater.

The Challenge

Bioventing is an accepted, effective remedial technique in the US. Natural attenuation has also rapidly gained acceptance as an effective remedial alternative for petroleum hydrocarbon compounds dissolved in groundwater. Both bioventing and natural attenuation remain to be accepted and applied on a widespread basis in Europe. The challenge in this effort is to satisfy the concerns of German regulatory authorities about these remediation approaches. This will pave the way for worldwide implementation of these cost-saving techniques.

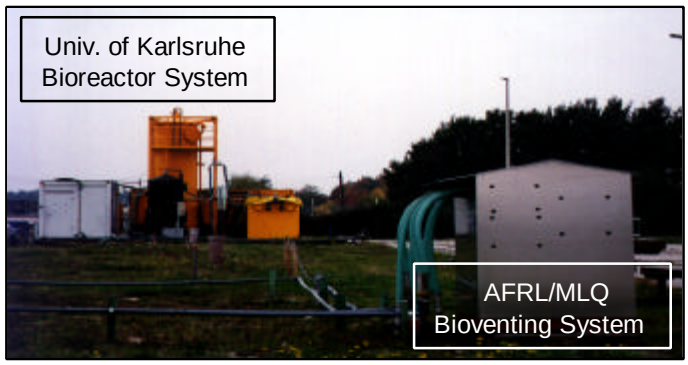
The Method

Bioventing uses forced aeration to enhance natural in situ biodegradation of petroleum contamination in the vadose zone. The forced aeration provides O_2 to the native soil microbial population that stimulates aerobic biodegradation of the contaminants. Bioventing is more cost-effective than traditional cleanup technologies such as excavation of the contaminated soil or SVE with off-gas treatment.



Natural attenuation is defined as the effective reduction of contaminant toxicity, mobility, or volume to levels protective of human health and the ecosystem through the biodegradation, dispersion, dilution, sorption, volatilization, and/or chemical and biochemical stabilization of the contaminants. Three lines of evidence can be used to support natural attenuation: documented loss of contaminants at the field-scale, contaminant and geochemical analytical data, and direct microbiological evidence.

A bioventing and natural attenuation study is being conducted at a fuel spill site at Rhein-Main Air Base, Frankfurt, Germany, to demonstrate the effectiveness of these techniques and provide the scientific data to address the concerns of the German environmental regulators.



Implementation

Battelle Memorial Institute accomplished construction of a pilot-scale bioventing system in the summer of 1996. The field site is contaminated with petroleum hydrocarbons from an old underground fuel transfer line. The system was designed and installed per the Air Force bioventing protocol. However, a more rigorous sampling and analysis plan was developed to address regulatory concerns such as the potential release of contaminated vapors through the soil surface. The Air Force protocol for natural attenuation of fuel contamination dissolved in groundwater is being applied at a nearby fuel-contaminated plume on Rhein-Main Air Base.

Current Status

The field demonstration at Rhein-Main Air Base is an international team effort; it is funded by SERDP and conducted under the auspices of the United States/German Data Exchange Agreement on Environmental Technologies. The German government contracted with the University of Karlsruhe to study more active soil and groundwater remediation technologies at the same field site. American and German scientists and engineers are exchanging real, practical experience gained from working side-by-side in the field. A final report, scheduled for March 1999, will describe the technical results from the study and provide a thorough cost analysis of the technologies demonstrated.

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